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## (54) Sample container for blood, urine, and the like with data carrier

(57) The invention pertains to a sample container for blood, urine, and the like, with a data carrier for patient data and for working data.

For simple and more reliable transmission and evaluation of both patient data and working data, a memory chip (52) is provided within a chip carrier (50) as the sole data carrier; the chip carrier can read in data from the keyboard of a computer over a read/write device (70). The stored data can then be automatically read out by the laboratory physician over a similar read/write device. Direct linkage with the measured values is also possible. The chip carrier (50) is clamped to the sample container or firmly bound to it in some other way.

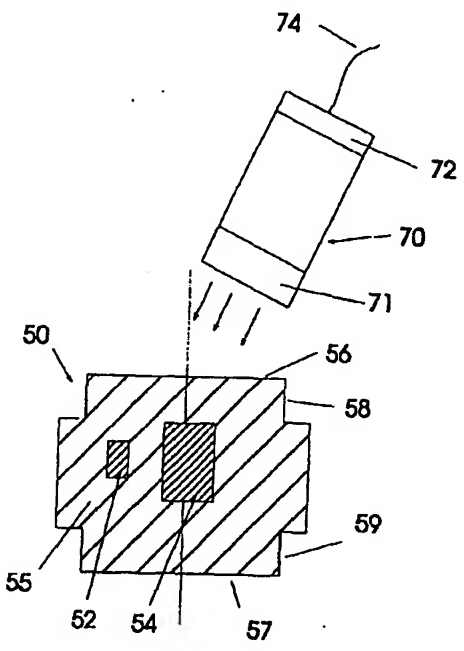


Fig. 7

## Specification

The invention pertains to a sample container in accordance with the governing concept of claim 1.

Sample containers of this type are particularly used to accommodate blood, urine, and the like from patients of the physicians, then to be sealed and sent to a special laboratory for examination. Up to now it has been customary to supply both the patient data and the information on the tests to be performed in a separate sheet that accompanies the sample. This is time-consuming and tedious, and entails the risk of confusion, especially with regard to the patient information. Therefore there has recently been an increasing trend toward reading in the patient data over a so-called bar code device to a corresponding label and adhering this to the sample container, usually made of glass. Upon reaching the investigating laboratory physician, the patient data label firmly attached to the sample container is read into a computer over a similar or identical bar code reader. Then the working data, i.e., the information on the tests to be performed, is input by hand into the computer from the data sheet, still submitted as usual. This work is relatively tedious, and in addition, confusion can still occur about the tests to be performed if some data sheets are mixed up.

The invention is based on the objective of designing a sample container in accordance with the governing concept of claim 1 in such a way that automated input of the data over a computer becomes possible, and that at least identification data are always firmly connected to the sample container.

In accordance with the invention the objective is accomplished through a sample container with the features of claim 1. Additional embodiments of the invention are protected in the sub-claims.

In the case of the subject of the invention, as the sole data carrier a memory chip is provided, which can be scanned over a data transmission unit with the aid of a reading device or a read/write device connected to a computer. The memory chip and the data transmission unit are arranged on a chip carrier that is connected permanently or removably to the sample container. The joining can be accomplished by a fitting piece that can be slid into an open end of the sample container, or over a cap in which the chip carrier is placed and which then is slid in a matching, tightly fitting way over the end of the sample container.

As a rule, the open end of the sample container is the end opposite the sample removal needle, and in which the sealing suction plunger or suction barrel for filling with blood or urine and the like under reduced pressure is arranged. The back end of the removal plunger can be

removed or broken off, and if needed the plunger itself can under certain circumstances be moved inward somewhat in order for the fitting piece of the chip carrier to be slid into the rear, open end of the sample container.

On the same chip carrier, several different fitting pieces for different internal diameters of sample containers may be provided. As the memory chip advantageously a so-called EEPROM is used, which is readily available commercially and freely programmable, i.e., data can be stored and read out again in any desired way. For transmitting the stored data and for reading in the data, a special electromagnetic coil may be used for memory purposes, which either itself functions as an antenna or works together with a corresponding antenna, so that a reading device or a read-write device in the form of an inductive reading device can read the data in and out without making contact, at a distance of less than about 5 cm from the chip carrier.

Various electrically insulated plastics may be used as the material for the chip carrier, for example cast epoxy resin. The cap can be made of elastic plastic or rubber.

The chip carrier for the memory chip and the data transmission unit electrically connected to it can also be integrated into the actuation barrel of the sample container, for example cast into it. In this case the chip carrier can also be identical to the actuation barrel. If a sample container in the form of a simple test tube with an open end that can be slid over a closing stopper and a closed, frequently rounded end is used, the memory chip along with the data transmission unit can also be arranged at the bottom of this test tube, either sealed off against the contents or in a cast-in chip carrier. Asimple cylindrical tube can also be utilized as a sample container, into the open end of which the chip carrier with integrated, for example cast-in memory chip and data transmission unit, can be slid in a sealing manner.

For example, the memory chip can be an EEPROM, the data transmission unit an electromagnetic coil, and an inductive pure reading device or combined read/write device can be used. During the programming or data input, an alternating current signal modulated in accordance with the data is transmitted to the electromagnetic coil and the memory chip over a corresponding electromagnetic transmitting coil as the reading device or read/write device. Conversely, during reading, a non-modulated alternating current signal is transmitted and a modulated alternating current signal is received. The programming or data input and the reading preferably take place over a computer keyboard of the read/write device.

Specifically, a read/write device can have as its basis a microprocessor that is actuated over a driver and receives, stores, and releases data over an EPROM, an $E^2$PROM, or EEPROM. In addition a modulator, a demodulator, and a monitoring element as well as an antenna are provided, and, of course, an energy supply.

The energy supply for the memory chip takes place over the reading device or the read/write device, and the same transmitting antenna thereof to the corresponding antenna of the memory chip in the form of the data transmission unit. The two antennas can consist of inductive electromagnetic coils, such as copper coils.

In addition to a rectifier, a voltage regulator, and a voltage resetter, the memory chip can contain a timing generator, a modulator, a demodulator, an EEPROM, and a communication circuit.

Exemplified embodiments of the invention are shown in the drawing.

This shows the following:

Fig. 1 a sample container and a chip carrier, not yet introduced,

Fig. 2 another, smaller sample container with chip carrier not yet introduced,

Fig. 3 an additional sample container and a cap arranged behind it, into which a chip carrier is fitted,

Fig. 4 the sample container according to Figure 1 with chip carrier inserted,

Fig. 5 the sample container according to Figure 2 with chip carrier inserted,

Fig. 6 the sample container according to Figure 3 with cap pressed on,

Fig. 7 a chip carrier, greatly enlarged, with memory chip inserted in it, and adjacent to it a data transmission unit, and a contactless read/write device,

Fig. 8 a functional diagram for data transmission,

Fig. 9 a sample container in which the microchip and the adjacent data transmission device connected electrically with it are contained in the actuation barrel,

Fig. 10 a sample container in the form of a test tube, in the bottom of which the chip carrier with memory chip and data transmission unit are cast in,

Fig. 11 a sample container in the form of a small tube, open on both sides, wherein at one end the chip carrier with memory chip and data transmission unit is cast in or inserted in a sealed manner,

Fig. 12 a read/write device for reading, programming, and input of data in the form of a circuit diagram,

Fig. 13 the memory chip and data transmission unit connected to it, attached to a sample container, in the form of a circuit diagram.

In Figure 1 the sample container, here in the form of a plastic or glass tube, is generally indicated by 10. At its top it has a small tube 12, on which a sterile collection needle or the like can be placed, which takes the sample, for example blood, either directly from the vein of the

individual being examined, or which draws in the sample from another container into the cylindrical interior space of the sample container. This purpose is accomplished by a removal barrel 16, which upon being withdrawn toward the rear creates a reduced pressure inside the sample container. Behind the sample container 10, a chip carrier 50 is arranged, which can be slid in the direction of the arrow into the back, open end 14 of the sample container 10, wherein at the same time the removal barrel or removal plunger 16, which is broken off at the back or from which the pulling handgrip was removed, is slid inside in the direction of the arrow. It should be noted that the seal as such in each case is produced by the removal barrel or removal plunger 16, so that it is only a matter of creating, through a suitable close-fit seat, a firm mechanical clamping connection or another connection with the sample container 10 in order for the memory chip 50 always to remain firmly connected with the sample container.

Figure 2 shows another exemplified embodiment for a sample container 20 of small diameter, with a front collection tube 22, a removal barrel 26 broken off at the back and, an end 24 open at the back. In comparison to the representation of Figure 1, the chip carrier 50 in Figure 2 is rotated through 180 degrees, so that the opposite end of the chip carrier 50, which is designed as a fitting piece 58 with a smaller diameter compared to the external diameter of the chip carrier 50, is turned toward the open end 24 of the sample container 20. The opposite fitting piece 59, with a smaller diameter than the first fitting piece, corresponding to the sample container of Figure 1, is thereby turned away from the sample container.

Figure 3 shows an additional exemplified embodiment of the invention in which the chip carrier 50 is fitted into a cap 60. If the cap 60 is slid in the direction of the arrow toward the back end 24 relative to the sample collection tube 32 on the sample container 30, the chip carrier 50 can be slid to the back within the cap 60 into an indentation that can correspond to the rear fitting seat 59. In this exemplified embodiment the back end 24 of the sample container 30 may also be closed, and for example may have only a single front introduction opening in the area of the test tube 32, which can also be replaced by a simple stopper.

Figure 4 shows in principle the same exemplified embodiment as Figure 1, with a chip carrier 50 slid in from the back, wherein under certain circumstances the rear, sealing end of the removal barrel 16 must be slid inward somewhat.

Figure 5 shows the exemplified embodiment represented in Figure 2, wherein the chip carrier 50 is slid with a fitting piece 58 — rotated relative to Figure 4 — into the open rear end of the sample container 20.

Figure 6 shows the exemplified embodiment represented in Figure 3, wherein the cap 60 is pushed over the back end of the sample container 30, wherein the chip carrier 50 is slid back

toward the base of the cap 60.

Figure 7 shows an enlarged exemplified embodiment of the chip carrier 50, shown in longitudinal sectional representation. The main body, which for example may consist of cast plastic or cast epoxy resin, is designated as 55. In this casting, a memory chip is shown at a certain distance relative to the longitudinal axis, and is arranged in the vicinity of a data transmission unit 54 drawn in centrally in the axis, in the form of a coil.

Above the chip carrier 50 on the right, an external read/ write device 70 is arranged, with an interior transmission portion 71, which in the case of the contactless transmission process can be arranged a maximum of about 5 cm from the chip carrier 50. The rear or internal transmission part 72 is connected over a cable 74 with a conventional computer, which on the basis of a special application program transmits the data obtained from the memory chip 52 over the coil 54 to the computer, where it can be read and processed. Conversely, data can be input into the computer over the computer keyboard and transmitted to the read/write device 70 and the coil 54 within the chip carrier 50 to the memory chip 52. A conventional EEPROM chip is advantageously used as the memory chip 52. In addition, in Figure 7 there is a novel front surface of the first fitting piece 58 is designated by 56, and the front surface of the opposite fitting piece 59, displaced through 180 degrees and angled conically toward the interior, is designated 57.

Figure 8 shows the example of a functional diagram for data transmission between the chip carrier 50 and the memory chip 52 in the form of an EEPROM and read/write device 70 or computer (not shown). The chip carrier 50 and the memory chip 52 arranged there and the sending/receiving coil 54 do not have their own power supply. The power supply is conveyed over the external read/write device 70, which is connected to the computer; it may for example be 140 KHz, 64 KHz, or 128 KHz. Both to the coil 54 and to the sending portion 71 of the read/write device 70, a transmitting antenna and a receiving antenna are each connected. The data transmission takes place by modulation of this emitting frequency and certain measures, conventional in circuitry, which are not the subject of the invention. It should be mentioned that an internal power supply of the chip carrier with its own power connection would be possible. The data are read out or read in and evaluated over a coder and decoder.

The sample container in accordance with the invention makes possible a firm, inseparable attachment of all data to a sample container, input over a conventional computer available in every medical practice, and a special handy read/write device, and the quick, fully automated evaluation of both the personal data and the working data by the laboratory physician in charge, and if desired, the linking of these data with the measured values obtained.

In the sample container according to Figure 9, the chip carrier is designated by 36; at the same time it represents the actuation barrel that can be moved in the direction of the arrow within the sample container 34 made of glass, plastic, or the like, to collect the sample and under certain circumstances to remove it again. In this actuation barrel 36, the memory chip 52 and the data transmission unit 54 are integrated, preferably cast in, in a sealing fashion. On the outside the barrel is equipped with an actuation rod 38, to the end of which the actuation lever 39 is attached. After the sample container has been filled, the actuation lever 38 can be broken off in a known manner at the assigned breakage site 41 for shipping. Removal of the sample then takes place after removal of the lid 35 provided on the opposite side of the tube 34.

In the exemplified embodiment of Figure 10, as the sample container a test tube 44 with cover 45 placed on it is provided. At its usually rounded off bottom, the chip carrier 46 is cast in or set in, in a sealing fashion. The memory chip 52 and the data transmission unit 54 are provided in the chip carrier 46, preferably cast in in a sealing fashion. The chip carrier can preferably consist of epoxy resin in this case also.

Figure 11 shows a sample container tube 64, open at both ends and thus particularly inexpensive. At one end the chip carrier 66 is slid in and connected in a sealing fashion with the tube 64. In the chip carrier 66 in turn the memory chip and the data transmission unit 54 are provided, which are electrically connected with one another. Here the data transmission unit 54 transmits over an antenna the signals to the read/write device or receives data from it.

The circuit diagram of Figure 12 shows a read/write device 70 with the essential submodules. The central piece is a microprocessor 102, which is actuated over a keyboard 100 and a driver 104. From the microprocessor 102, a line strand leads to the EPROM 106 and the EEPROM 108; an additional line leads to a modulator 114, which modulates the basic frequency of the microprocessor 102 corresponding to the data to be transmitted and leads over an RF driver 116 to the send/receive antenna 118. On the other hand, data received by the antenna 118 are sent to the demodulator 112, which transmits the data to the microprocessor 102 for further processing and, if desired, storage.

A monitoring element 110 is provided for circuit monitoring.

Alongside the read/write device 70, the antenna 218 of the data transmission unit 54 is arranged; it is connected electrically to the memory chip. A first type of data, which is transmitted from the memory chip 52 of the sample container, is designated by 122 and serves for energy supply; a second type of data, which can be transmitted both from the read/write device 70 to the memory chip 52 and in the opposite direction, is designated by 124 and serves for transmitting data between the read/write device 70 and the memory chip 52.

The antenna 218 of the data transmission unit 54 on the sample container, i.e., as a rule on the chip carrier, is connected on one hand to a rectifier to which a voltage regulator 206 and a reset voltage 204 is supplied. On the other hand, the antenna 218 is connected to a timing generator 208, modulator 212 for data to be transmitted, and a demodulator 210 for data received. This antenna preferably consists of a copper coil. The core piece of the memory chip is an EEPROM 216 and a communication circuit 214 connected to it.

**Claims**

1. Sample container for blood, urine, and the like, with at least one data carrier connected to it for patient data, for operating data, i.e., for the tests to be conducted on the sample, and for identification of the sample container,
characterized in that
a) as the data carrier, a read/write memory chip for identifying the sample container and/or for examination parameters that remain constant, or a read/write memory chip (5) is also used for individual data input,
b) a data transmission unit (54) electrically connected to the memory chip (52) and interacting with it is provided,
c) it can be scanned by a reading device or a read/write device to store both patient data and/or operating data in the memory chip (52), and on the other hand to read the stored data,
d) that the memory chip (52) is permanently connected to the sample container.

2. Sample container in accordance with claim 1, characterized in that the memory chip (52) and the data transmission unit (54) are fastened to a chip carrier (50) or cast into it.

3. Sample container in accordance with claim 2, characterized in that the chip carrier (50) has at least one fitting piece (58, 59) that can be tightly slid into one open end (14, 24) of the sample container (10, 20),
or that the chip carrier (50) fits into a cap (60) that can be slid tightly onto one open or closed end (24) of the sample container (30).

4. Sample container in accordance with claim 3, characterized in that the chip carrier (50) has various fitting pieces, preferably one fitting piece (58, 59) at each of two opposite ends, with different diameters for different internal diameters.

5. Sample container in accordance with one of the claims 1 to 4, characterized in that the memory chip (52) is an EEPROM, that the data transmission unit (54) is an electromagnetic coil, that an inductive read/write device (70) is used which emits an appropriately modulated alternating-current signal to the coil during programming or data input, and which, upon reading, emits a non-modulated alternating current signal and receives a modulated alternating current signal, wherein programming or data input and reading preferably take place over a computer keyboard of the read/write device (70), and wherein in the data transmission the power supply of the memory chip (52) is provided from this device over the same antenna.

6. Sample container in accordance with claim 5, characterized in that the frequency of the alternating current signal is 130-160 kHz.

7. Sample container in accordance with one of the claims 1 through 6, characterized in that the chip carrier (50) is a plastic casting into which the memory chip (52) and adjacent to this and electrically connected to the memory chip, the data transmission unit (54) is cast in.

8. Sample container in accordance with one of the claims 1 through 7, characterized in that the cap (60) is an elastic plastic or rubber cap.

9. Sample container in accordance with one of the claims 1 through 7, characterized in that the memory chip (52) and the data transmission unit (54) electrically connected to it is connected to the barrel (36), preferably cast into it.

10. Sample container in accordance with one of the claims 1 through 7, characterized in that the memory chip (52) with the data transmission unit (54) electrically connected to it is sealed into the closed end of a U-shaped sample container such as a test tube, preferably via synthetic resin.

11. Sample container in accordance with one of the claims 1 through 7, characterized in that the memory chip (52) as well as the data transmission unit (54) electrically connected to it are fastened to a chip carrier (66) which is slid in at one free end of a tubular sample container open at both sides and connected to it in sealing fashion.

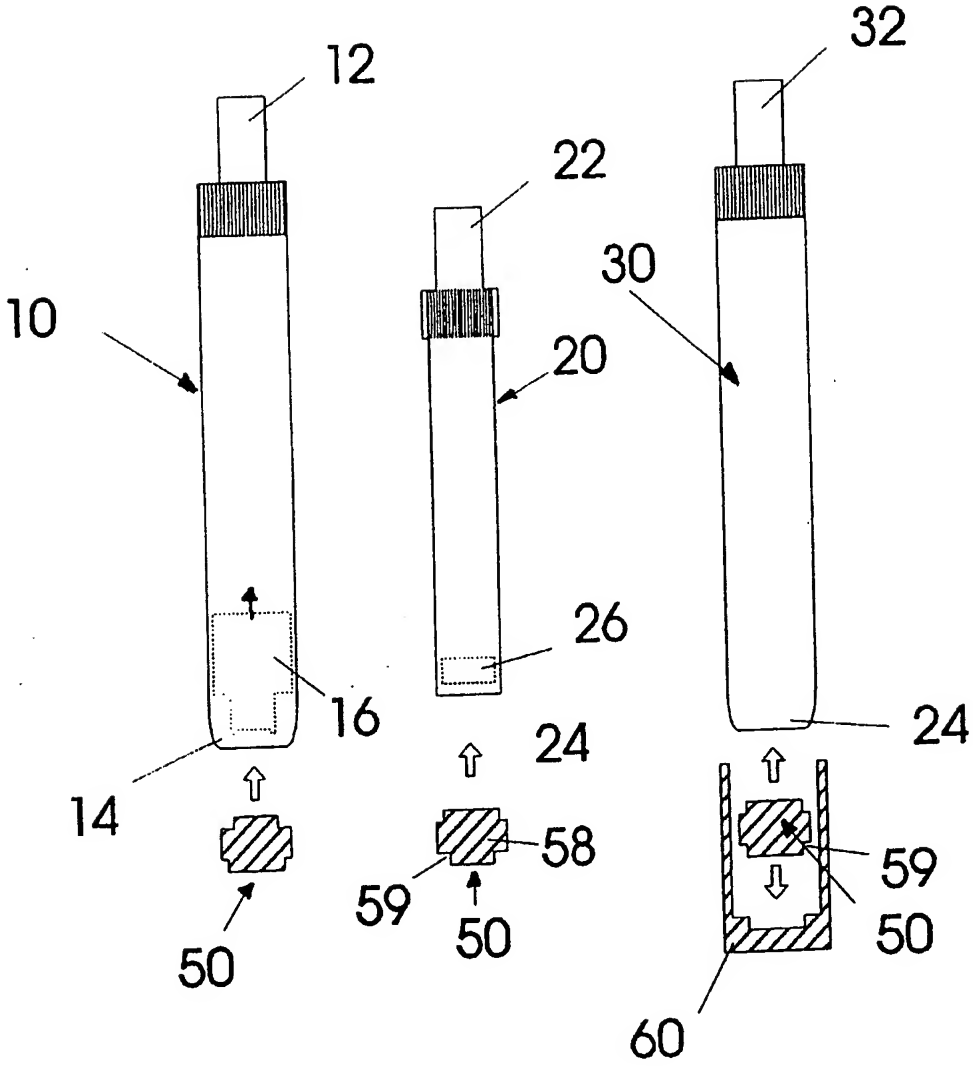


Fig. 1 Fig. 2 Fig. 3

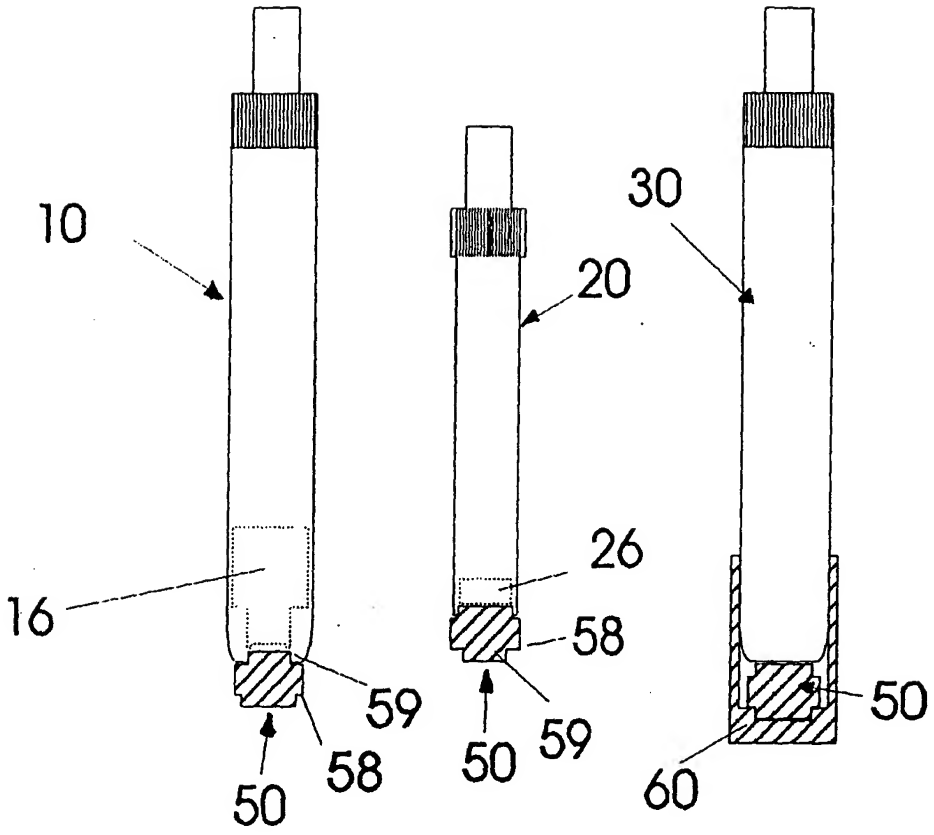


Fig. 4 Fig. 5 Fig. 6

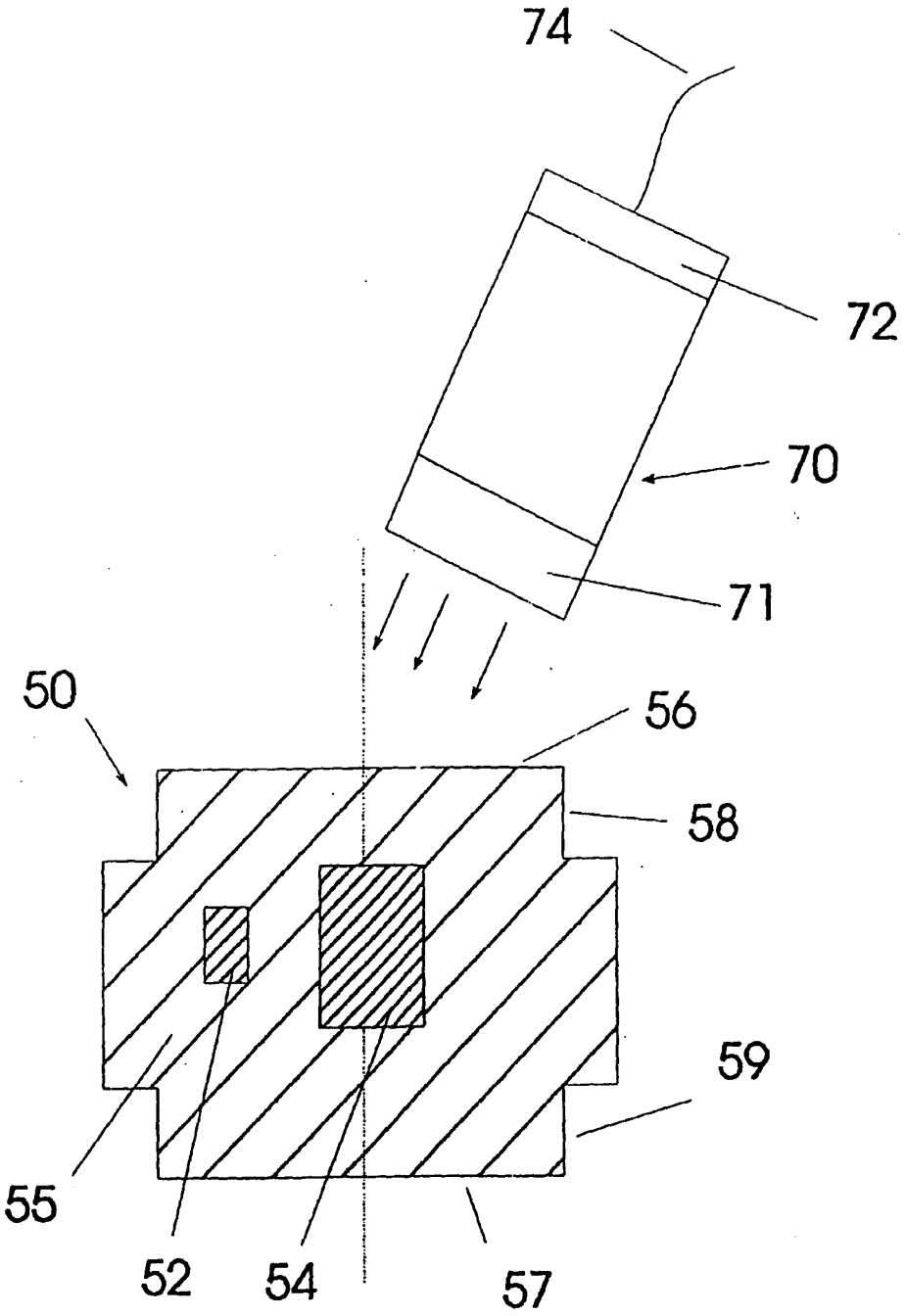


Fig. 7

Figure 8.

| | | |
|---|---|---|
| Power supply | Power supply via antenna without battery | |
| Transmitter | Frequency divider | |
| Receiver | Modulator | EEPROM |
| Data decoder and communication | Data transmitter | |

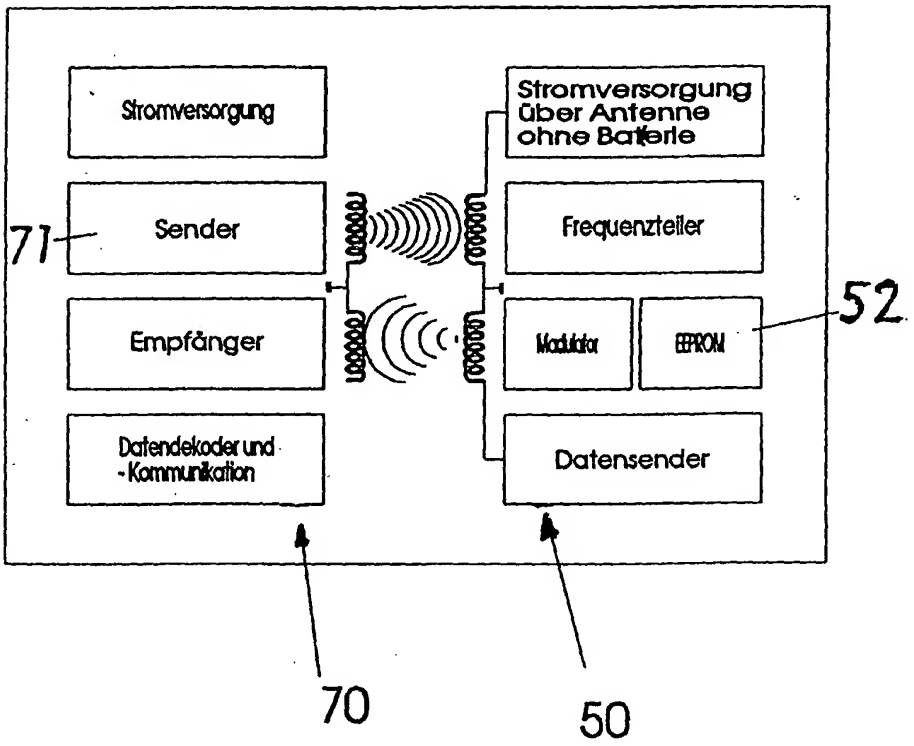


Fig.8

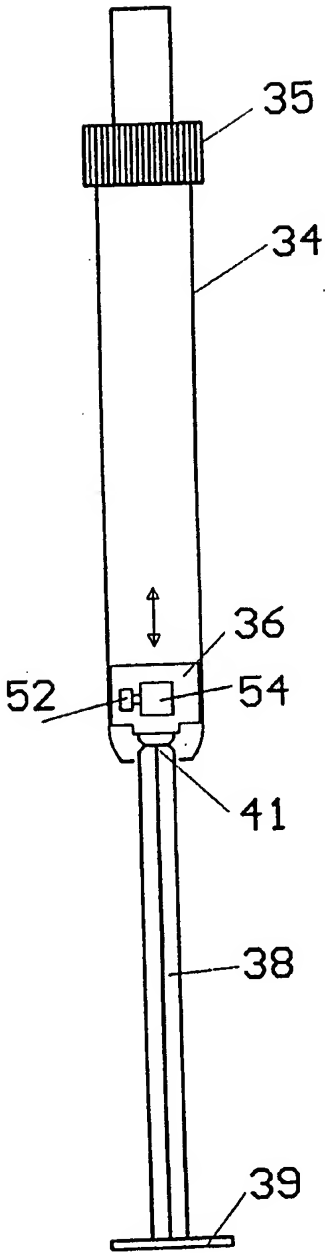


FIG.9

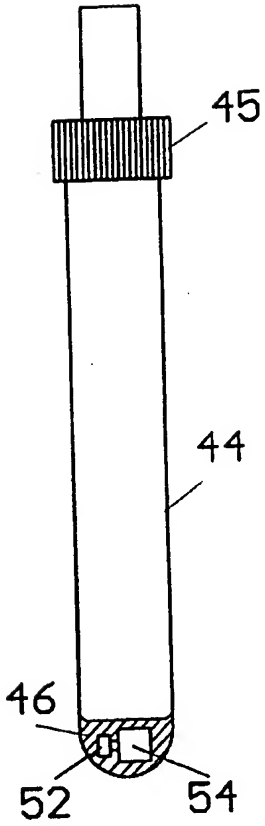


FIG.10

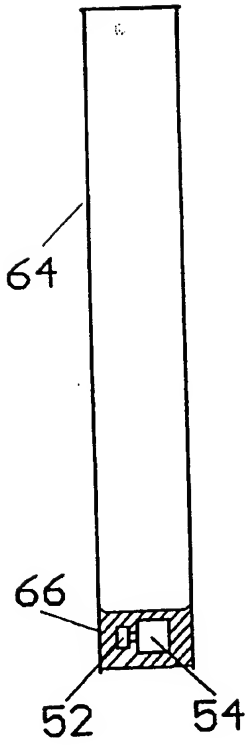


FIG.11

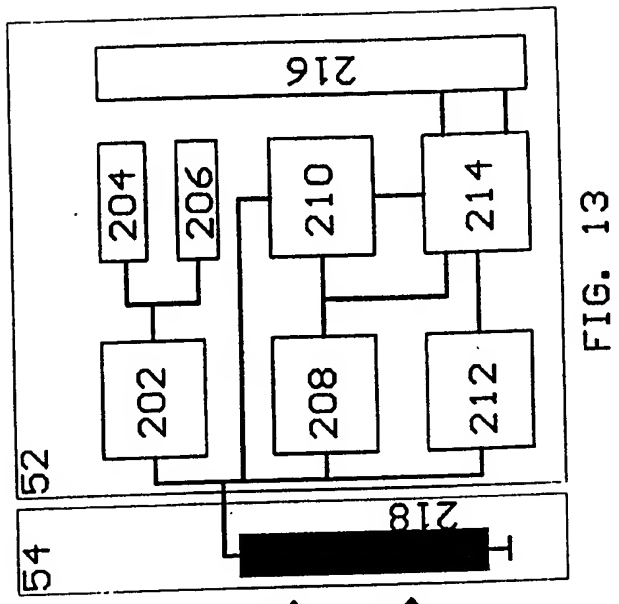
216
204
206
210
214
202
208
212
52
54
218

FIG. 13

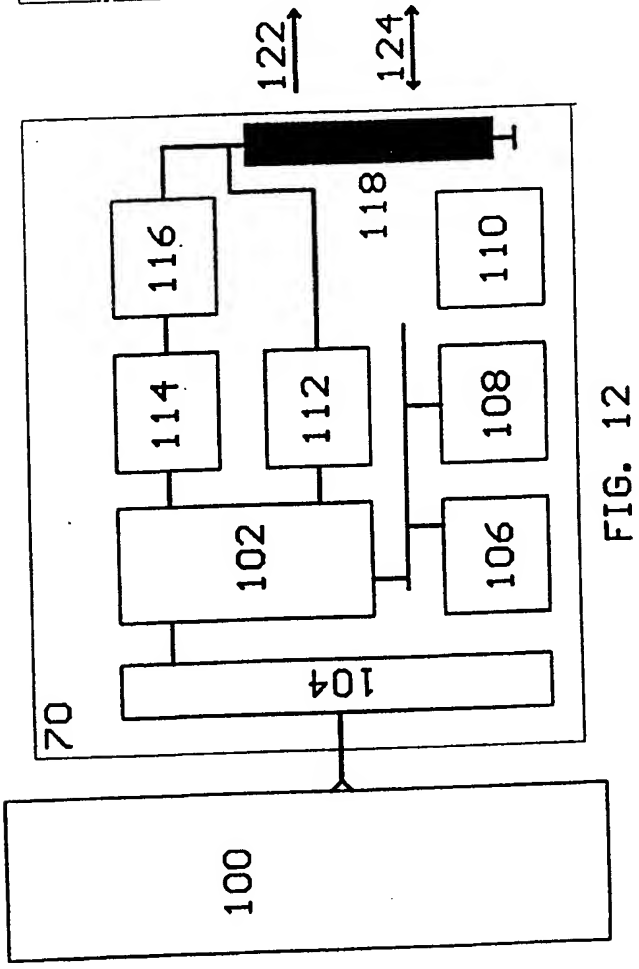
122
124
118
116
110
114
112
108
102
106
104
70
100

FIG. 12